PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference BP105093/JJO	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/FI2002/000954	International filing date *(day/month/year)* 27-11-2002	Priority date *(day/month/year)* -
International Patent Classification (IPC) or national classification and IPC G11B 7/08, G11B 7/12, G11B 7/135		
Applicant Nokia Corporation et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 9 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))
      _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))

☐ publication of the international application (under Rule 12.4)

☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-22 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 1-9 received by this Authority on 02.03.2005

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1/22-22/22 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-49	YES
	Claims		NO
Inventive step (IS)	Claims	1-49	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-49	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention relates to a device and a method for writing and/or reading digital information on/from an optical storage medium, the device comprising a light source emitting at least a first light beam and a second light beam. The light beams are directed towards the optical storage medium using an optical system and reflected therefrom towards detector arangements for reading data and/or for tracking/focusing purposes, at least the first light beam being guided transversal towards the data tracks in accordance with the movements of the access unit. The access unit being e.g. a swing arm carries the optical system and optionally the light source and/or detector arrangement and is arranged to pivot on one end in order to move in three dimensions in relation to the pivot point.

Documents cited in the International Search Report:

D1: US 6 215 755 B1
D2: US 5 771 219 A
D3: US 4 253 723 A
D4: US 4 157 568 A
D5: WO 98 09 392 A2
D6: US 6 278 682 B1
D7: Patent Abstract of Japan, abstract of JP 90 73657 A

The document D1 discloses an optical data storage device comprising a read/write arm, drive means for positioning the arm in three dimensions, at least one light source generating a read/write light beam and an optical storage medium. The device also comprises necessary tracking and focusing means for controlling the beam position and focus (see column 6, lines 8-31).

.../...

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of: Box V

The subject-matter of claims 1 and 27 differs from this known system in that there are at least two light beams and that at least the first light beam is guided transversely towards the data tracks in accordance with the movements of the access unit. A further difference is that the access unit according to the invention is movable three-dimensionally in relation to a pivot point to provide a three-dimensional movement of the light beams.

According to D2 (see column 14, line 35-column 15, line 42, figures 12 and 13), an optical recording/reproducing device is known in which three light beams are directed towards an optical storage medium, two beams of which are used for tracking and focusing and one beam is used for writing and/or reading. According to the shown embodiment, the beams are directed transversely towards the data tracks on the medium and reflected therefrom towards a detector arrangement.

From D3 an apparatus for optically reading information from a record carrier is known. Here, a single light beam is used for reading and focusing, the beam being guided transversely towards the data tracks.

D4 shows a method and an apparatus for optically reproducing a storage medium, wherein the use of separate beams for reading (and/or writing) and tracking/focusing is described. According to D4, the read beam is directed perpendicular to the data tracks while the tracking/focusing beam is directed transversely towards the tracks and reflected back to a detector arrangement for controlling the focus of the read beam.

The invention as claimed in claims 1 and 27 differs from the known devices according to D2-D4 by using an access unit being movable in three dimensions in relation to a pivot point, allowing the light beams to be moved three-dimensionally.

Documents D5-D7 describe the general state of the art relating to optical storage devices and method for reading and writing optical record carriers.

The claimed invention as described in claims 1 and 27 is therefore novel (Article 33(2) PCT).

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

The document D1 is regarded as representing the closest prior art to the subject-matter of claims 1 and 27.

The difference between the invention and the closest prior-art is constituted by the use of at least one first and one second light beam, the at least one first light beam being guided transversely towards the data tracks in accordance with the movements of the access unit. A further difference is that the access unit according to the invention is movable three-dimensionally in relation to a pivot point to provide a three-dimensional movement of the light beams.

These differences are considered to solve several problems, as described below:

Plural light beams are used for different purposes, such as reading, writing, tracking and focussing. However, the use of plural light beams for different purposes are well known in the art, as seen from D2 and D4.

The purpose of guiding at least one light beam transversely towards the data tracks is to separate the illuminating light beam and reflected light beam to provide a more reliable reading and/or tracking/focussing function.

It is however, known from the cited prior-art (see D2-D4) to guide at least one light beam transversely towards the data tracks for the purpose of separating the illuminating and reflected light beams.

It is not however, known from any of the cited prior-art documents an access unit being movable in three dimensions in relation to a pivoting point, in order to provide a three-dimensional movement of the light beams combined with guiding the light beam(s) transversely towards the data tracks.

The remaining problem to be solved by the present invention may therefore be regarded as providing a low weight access unit having improved movability in three dimensions giving an increased reliability for reading and tracking/focussing functions.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

The solution to this problem proposed in claims 1 and 27 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

None of the cited documents shows or suggests a read/write device for an optical memory as described in the claims, neither do they consider the possibility of increasing the reading and tracking/focussing reliability by allowing the light beams to move three-dimensionally.

Claims 2-26 and 28-49 are dependent on claims 1 and 27 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.

The invention also has industrial applicability.

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Claims

1. A device comprising an optical storage medium drive (81) and at least one access unit (83) for reading out data from and writing data to an optical storage medium (82) comprising a plurality of data tracks (70), said device comprising: at least one light source (84) arranged to produce at least one first light beam (21, 31) and at least one second light beam (22, 32); transmitting means (85) arranged to transmit and guide said first light beam and said second light beam towards said data tracks of the optical storage medium; and detecting means (86) arranged to detect light beams that are reflected (33) from the surface of the optical storage medium, **characterised** in that

- said access unit (10, 50, 83) is arranged to pivot on one end in order to move three-dimensionally in relation to the pivot point (101),

- said transmitting means (14, 15, 16, 85) and said detecting means (17, 18, 86) are arranged to move in accordance with the movement of said access unit,

- said transmitting means (14, 15, 16, 85) are arranged to guide said first light beam transversal towards data tracks of the optical storage medium in accordance with the movement of said access unit, and

- said detecting means (17, 18, 86) are arranged to receive the reflected beams of said first light beam or said second light beam from said data tracks of the optical storage medium in order to control the movement of said access unit.

2. A device according to claim 1, **characterised** in that said transmitting means (14, 15, 16, 85) are arranged to guide said first light beam and said second light beam transversal towards data tracks of the optical storage medium in accordance with the movement of said access unit.

3. A device according to claim 1 or 2, **characterised** in that said access unit (10, 50, 83) is arranged to be movable to a position, in which said first light beam (21, 31) and said second light beam (22, 32) transmitted from said transmitting means (14, 15, 16, 85) towards said data tracks of the optical storage medium (11, 82) form a first point (29a) and a second point (29b) on said data tracks of the optical storage medium (11)where the reflected light beams are detected to be in focus and on track by said detecting means (17, 18, 86).

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4. A device according to claim 3, **characterised** in that said first point is arranged to be located in a different location than said second point on said data tracks of the optical storage medium.

5. A device according to claim 3 or 4, **characterised** in that said first point is arranged to be located slightly ahead of said second point on said data tracks of the optical storage medium.

6. A device according to claim 3, **characterised** in that said first point and said second point are arranged to be located in a same intersection point (29) on the track of the optical storage medium.

7. A device according to claim 1, **characterised** in that said transmitting means are arranged to guide said first light beam transversal towards said data tracks of the optical storage medium, and said second light beam perpendicular to said data tracks of the optical storage medium.

8. A device according to claim 7, **characterised** in that said first light beam is arranged to read out data from said data tracks of the optical storage medium and said second light beam is arranged to write data to said data tracks of the optical storage medium.

9. A device according to any of claims 1 to 8, **characterised** in that at least one light source (12) is arranged to be located at or substantial proximity of the pivot point (101) of said access unit (10).

10. A device according to claim 1, **characterised** in that said transmitting means (14, 15, 16) comprise at least one first optical component (15, 15a, 24, 25, 36) for bending said first light beam and said second light beam towards said data tracks of the optical storage medium (11), and at least one second optical component (16, 27, 28, 35) for bending and focussing said first light beam and said second light beam transversal towards said data tracks of the optical storage medium.

11. A device according to claim 10, **characterised** in that said transmitting means (14, 15, 16) further comprise collimating optics (14, 14a) for said light source (12), splitting optics for splitting the emitted light into multiple light beams and focusing optics in connection with said second optical component (16, 27, 28).

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12. A device according to claim 10, **characterised** in that said first optical component and said second optical component are arranged to be a single lens (35) for bending and focussing said first light beam transversal towards said data tracks of the optical storage medium and said second light beam perpendicular to said data tracks of the optical storage medium.

13. A device according to claim 10, **characterised** in that said first light beam and said second light beam are arranged to have opposite polarizations.

14. A device according to claim 10, **characterised** in that said first light beam and said second light beam are arranged to have different wavelengths.

15. A device according to any of claims 1 to 14, **characterised** in that said first light beam is arranged to be produced by a first laser source (51) and be transmitted by first transmitting means (56); said second light beam is arranged to be produced by a second laser source (52) and be transmitted by second transmitting means (58); and said first laser source and said second laser source are arranged to be synchronized by synchronizing means (55).

16. A device according to claim 15, **characterised** in that said first transmitting means (56) and said second transmitting means (58) are arranged to use the same first and second optical components (15, 16).

17. A device according to any of claims 1 to 16, **characterised** in that said detecting means (17, 18) comprise at least one detector element (18) for detecting the reflected light beams of said first light beam or said second light beam, and a third optical component (17) for bending and focussing said reflected light beams of said first or second light beam.

18. A device according to claim 17, **characterised** in that said detecting means (17, 18) further comprise a fourth optical component (15b) for bending the reflected light beams of said first light beam or said second light beam towards said detector element (18), focussing optics (14b) in front of said detector element and splitting optics (17b) for splitting said reflected light beams of said first light beam or said second light beam into multiple light beams.

19. A device according to claim 17 or 18, **characterised** in that said detector element (18) comprises at least two detector surfaces (18a, 18b, 18c, 18d) for detecting the focusing signal and tracking signal of the reflected light beams (1a, 1b, 1c) of said first light beam or said second light beam.

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20. A device according to any of claims 17 to 19, **characterised** in that said detector element (18) is arranged to detect by said detector surface (18a, 18b, 18c, 18d) of said detector element at least one focusing signal and at least one tracking signal of the reflected beams (1a, 1b, 1c) of said first light beam or said second light beam received from the surface of the optical storage medium (11), and said detector element is arranged to control the movement of said access unit (10) according to said focusing signal and said tracking signal detected by said detector surface to keep said first light beam and said second light beam in focus and on track.

21. A device according to any of claims 17 to 20, **characterised** in that said detector element (18) is arranged to detect by said detector surface (18a, 18b, 18c, 18d) of said detector element identifying a change in the intensity distribution of at least one focusing signal and at least one tracking signal of the reflected beams of said first light beam or said second light beam received from the surface of the optical storage medium, and said detector element is arranged to control the movement of said access unit by following said change in the intensity distribution to keep said first light beam and said second light beam in focus and on track.

22. A device according to any claims 18 to 21, **characterised** in that said focussing optics (17, 28) in front of said detector element (18, 26) comprises diffractive optical elements (27).

23. A device according to any of claims 1 to 22, **characterised** in that said transmitting means (14, 15, 16) and said detecting means (17, 18) further comprise a waveguide or lightguide (13) arranged to transmit said first and second light beam and/or said reflected light beams of said first light beam or said second light beam along said access unit.

24. A device according to any of claims 1 to 23, **characterised** in that said access unit (10, 50, 83) is an arm unit (41).

25. A device according to any of claims 1 to 23, **characterised** in that the device comprises a first access unit for reading out data from the optical storage medium, and a second access unit for writing data to the optical storage medium, wherein said first access unit and said second access unit is one of the following: an arm unit (41), a sledge unit (45) or any combination of an arm and sledge unit (41, 42, 45).

26. A device according to any of claims 1 to 25, **characterised** in that said device (80) is a communication device.

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27. A method for reading out data from and writing data to an optical storage medium in a device comprising at least one access unit, the method comprising steps, in which: at least one optical storage medium comprising a plurality of data tracks, stores data; an optical storage medium driver controls operation of the device; at least one light source produces at least one first light beam and at least one second light beam (901); said first light beam and said second light beam are transmitted and guided towards said data tracks of the optical storage medium (907); and the light beams that are reflected from the surface of the optical storage medium are detected, **characterised** in that it further comprises steps, in which:

- said first light beam and said second light beam are guided transversal towards said data data tracks of the optical storage medium (909) three-dimensionally;

- the reflected beams of said first light beam or said second light beam from said data tracks of the optical storage medium are received (911, 913) three-dimensionally; and

- said access unit is moved three-dimensionally in relation to a pivot point on one end to focus and track said first and second light beams (915, 916, 917, 919, 920).

28. A method according to claim 27, **characterised** in that it comprises step, in which said access unit is controllable to a position, in which said first light beam and said second light beam transmitted and the reflected light beams of said first light beam or said second light beam detected (913), to form at least one first focussed beam and at least one second focussed beam on said data tracks of the optical storage medium on the basis of said first light beam (915), said second light beam and said reflected light beam of said first light beam or said second light beam.

29. A method according to claim 28, **characterised** in that it comprises steps, in which said first focussed beam forms at least one first point (29a) and said second focussed beam at least one second point (29b) on said data tracks of the optical storage medium (915).

30. A method according to claim 29, **characterised** in that it comprises a step, in which said first point is located in a different location than said second point on said tracks of the optical storage medium.

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31. A method according to claim 29 or 30, **characterised** in that it comprises a step, in which said first point is located slightly ahead of said second point on said tracks of the optical storage medium.

32. A method according to claim 29, **characterised** in that it comprises a step, in which said first point and said second point are located in a same intersection point (29) on the track of the optical storage medium.

33. A method according to any of claims 27 to 32, **characterised** in that it comprises steps (909), in which said first light beam is transmitted and guided transversal towards said data tracks of the optical storage medium, and said second light beam perpendicular to said data tracks of the optical storage medium.

34. A method according to claim 33, **characterised** in that it comprises steps, in which said first light beam reads out data from and said second light beam writes data to said data tracks of the optical storage medium.

35. A method according to any of claims 27 to 34, **characterised** in that it comprises steps (909), in which at least one first optical component bends said first light beam and said second light beam towards said data tracks of the optical storage medium, and at least one second optical component bends and focuses said first light beam and second light beam transversal towards said data tracks of the optical storage medium.

36. A method according to claim 35, **characterised** in that it further comprises steps, in which collimating optics collimates said light source, splitting optics splits the emitted light into multiple light beams (905) and focusing optics in connection with said second component focuses light beams (915).

37. A method according to claim 35, **characterised** in that it comprises steps (909), in which said first optical component and second optical component is a single lens that bends and focuses said first light beam transversal towards said data tracks of the optical storage medium and said second light beam perpendicular to said data tracks of the optical storage medium.

38. A method according to claim 35, **characterised** in that said first light beam and said second light beam have opposite polarizations.

39. A method according to claim 35, **characterised** in that said first light beam and said second light beam have different wavelengths.

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40. A method according to claim 27, wherein the method comprises steps, in which a first laser source produces said first light beam and a second laser source produces said second light beam (901); and said first laser source and said second laser source are synchronized (903), **characterised** in that a synchronization (903) comprises steps, in which

- a first laser source and a second laser source are initialised separately,
- said first laser source turns on (111),
- said first laser source emits said first light beam and a first point is located for read/write operation (113),
- a location of said first point is analysed (115, 117),
- a focusing and tracking of said first point is analysed (116, 118),
- said second laser source turns on (119),
- said second laser source emits said second light beam and a second point is located for read/write operation (120, 121), and
- said second laser source turns off after said read/write operation (123).

41. A method according to claim 40, **characterised** in that a synchronization comprises steps, in which said second laser source turns on resulting said first laser source to go in an interrupt mode for a predetermined time period to said first point (139), and said first laser source continues read/write operation from said first point after the predetermined time period and said second laser source goes in an interrupt mode (141, 143).

42. A method according to any of claims 27 to 41, **characterised** in that it comprises steps (915, 917), in which at least one detector element detects the reflected light beams of said first light beam or said second light beam and a third optical component bends and focuses said reflected light beams of said first light beam or said second light beam.

43. A method according to claim 42, **characterised** in that it further comprises steps (915, 917), in which a fourth optical component bends said reflected light beams of said first light beam or said second light beam towards said detector element, focussing optics in front of said detector element focuses and splitting optics

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splits said reflected light beams of said first light beam or said second light beam into multiple light beams.

44. A method according to claim 42 or 43, **characterised** in that said detector element comprises at least two detector surfaces for detecting the focusing signal and tracking signal of the reflected light beams of said first light beam or said second light beam.

45. A method according to any of claims 42 to 44, **characterised** in that said detector element detects by said detector surface of said detector element at least one focusing signal and at least one tracking signal of the reflected beams of said first light beam or said second light beam received from the surface of the optical storage medium, and said detector element controls the movement of said access unit according to said focusing signal and said tracking signal detected by said detector surface to keep said first light beam and said second light beam in focus and on track.

46. A method according to any of claims 42 or 45, **characterised** in that said detector element detects by said detector surface of said detector element identifying a change in the intensity distribution of at least one focusing signal and at least one tracking signal of the reflected beams of said first light beam or said second light beam received from the surface of the optical storage medium, and said detector element controls the movement of said access unit by following said change in the intensity distribution to keep said first light beam and said second light beam in focus and on track.

47. A method according to any of claims 27 to 46, **characterised** in that it said access unit is an arm unit.

48. A method according to any of claims 27 to 46, **characterised** in that it comprises steps, in which a first access unit reads out data from the optical storage medium, and a second access unit writes data to the optical storage medium, wherein said first and said second access unit is one of the following: an arm unit, a sledge unit or any combination of an arm and sledge unit.

49. A method according to any of claims 27 to 48, **characterised** in that it said device is a communication device.